

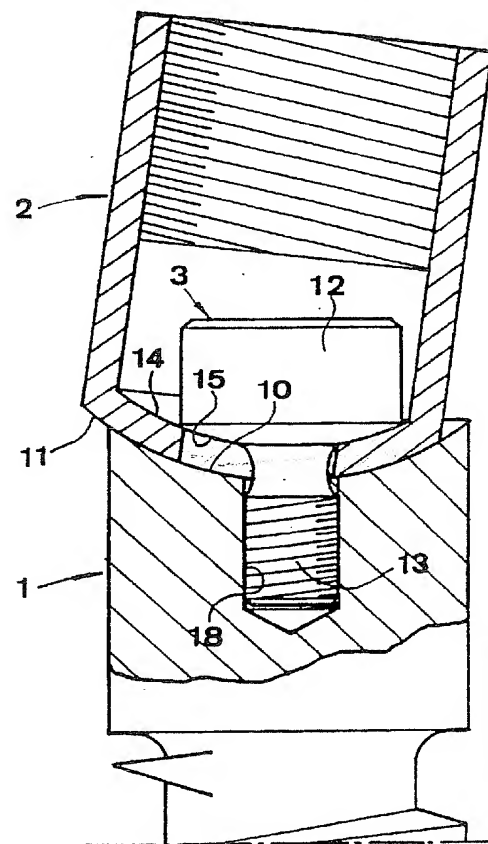


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/SE91/00577 (22) International Filing Date: 4 September 1991 (04.09.91) (30) Priority data: 9002805-1 4 September 1990 (04.09.90) SE (71)(72) Applicant and Inventor: WILJE, Oscar [SE/SE]; Box 140, S-791 23 Falun (SE). (74) Agent: BJERKÉN, Jarl, Håkan; Bjerkéns/Gävle Patentbyrå AB, Box 304, S-801 04 Gävle (SE). (81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU ⁺ , TD (OAPI patent), TG (OAPI patent), US.		Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>

(54) Title: A DEVICE FOR ANCHORING PROSTHESES**(57) Abstract**

A device for anchoring prostheses, in particular dental prostheses, comprises a securing member (1) to be secured in bone tissue, a support member (2) for supporting the prosthesis and means (3, 12, 13, 18) for connecting the securing member and support member, the support member and securing member comprising cooperating first surfaces (11, 10), which are complementary concave and convex respectively and arranged to allow adjustment of the position of the support member (2) relative to the securing member (1), the adjusted position being securable by means of the connections means comprising a first member (12) for applying forces on the support member (2) actuating the same into engagement with the securing member (1). The first member (12) is arranged to apply the forces on the support member (2) via cooperating second surfaces (15, 14) which are complementary concave and convex respectively.



+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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A device for anchoring prostheses

FIELD OF THE INVENTION AND PRIOR ART

This invention is related to a device for anchoring prostheses, in particular dental prostheses, in accordance with the preamble of the appended claim 1.

Such a device is disclosed in the applicant's own PCT/SE 89/00618 (WO 90/04951), said device having turned out to be extremely advantageous due to the possibility to incline the securing member and the support member and due to the tightening action of the connection means based upon contact over relatively large areas between complementary convex/concave surfaces. Nevertheless, the device known suffers from the disadvantage that it is somewhat complicated. Thus, the connection means comprise a screw and a nut cooperating therewith, said nut being received in a cavity in the securing member and abutting tighteningly against a wall portion restricting the cavity, said wall portion comprising a hole for receiving the threaded shank of the screw, said hole passing through the concave (or convex) surface of the securing member. Thus, the nut will remain in the cavity on release of the connection means. The wall portion comprising the hole for the threaded shank of the screw is formed by a washer secured to the securing member by means of press fit or similar. The longitudinal axis of the screw will always be parallel to a longitudinal axis of the support member, which means that the nut on inclination of the support member relative to the securing member will

move sidewardly in the cavity.

SUMMARY OF THE INVENTION

The present invention has the object to develop the device known and recited initially so that the device will be more simple from a constructional point of view and probably also more reliable by the need for elements attached by press fit or similar having been eliminated while the possibility to inclination of the support member relative to the securing member is maintained or even improved.

This object is obtained, according to the present invention, by that which primarily is defined in the characterising part of the enclosed claim 1. In that way possibilities are created for an uncomplicated engagement, preferably by means of threads, between the connecting means and the securing member, the possibility for inclination of the support member relative to the securing member being maintained since the first member of the connection means is adapted to apply the forces on the support member via cooperating second surfaces which are complementary concave and convex respectively.

Preferable developments of the concept according to the invention are subject for the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the enclosed drawings, a more close description of an embodiment example of the invention will follow hereinafter.

In the drawings:

Fig 1 is an exploded illustration of the complete device according to the invention as viewed from the side;

Fig 2 is a longitudinal section through an upper portion of the device according to Fig 1, however, the device being in assembled state;

Fig 3 is a view similar to Fig 2 but illustrating the possibility for inclination between parts of the device; and

Figs 4 and 5 are views similar to Figs 2 and 3 but illustrating a slightly modified embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The device according to the invention will hereinafter be described as being particularly adapted for anchoring prostheses in the form of dental prostheses. However, it should be noted that the device according to the invention may be used in other prostheses anchoring situations.

Figs 1-3

As appears from Fig 1, the device comprises a securing member 1 to be secured in bone tissue and a support member 2 for supporting the prosthesis in question. As will be described more closely hereinafter, means for connecting the securing member 1 and support member 2 to each other comprise, suitably, a screw 3.

The securing member 1 is provided with a thread 4, which may be in the form of a trapezoidal thread or a round thread. A trapezoidal thread is illustrated as an example in Fig 1. The advantage in using a trapezoidal thread or a round thread is that these two thread types allow a much larger amount of material between adjacent thread revolutions than conventionally used fine threads. Since anchoring is to occur in a relatively porous material (the skeleton bone) a trapezoidal thread or a round thread cause a much better chance for a good attachment and homogenising with the bone tissue due to the larger amount and height of material.

The securing member 1 according to the invention is suitably designed so that it is self-tapping upon screwing into a prebored hole in the bone tissue. In order to achieve this the securing member 1 is provided with cuts 5, only one of which appears in Fig 1. These cuts are distributed about the securing member and extend axially in relation to the securing member while forming tapping cutting edges 6 on the thread of the securing member.

It is preferred that the securing member 1 comprises guide means 7 to simplify alignment of the securing member 1 in an axial position relative to the hole prebored in the bone tissue. This guide means 7 has, in the embodiment, the character of an end portion of the securing member 1, said end portion being without thread. The end portion may be cylindrical and/or more or less conical or tapering at the extreme end thereof. The guide means 7 also simplifies the first phase of the tapping operation in the prebored hole.

In order to provide a place to escape for the tissue material released in the tapping operation, a cavity 8 may be arranged in the securing member 1, the volume of the cavity corresponding to the volume of the tissue material released. Thus, the cavity 8 will receive the tissue material released during the tapping operation as it proceeds. The cavity 8 has preferably the character of a transverse hole through the securing member 1 in the area of its tapping cutting edges 6. In addition, it should be emphasised that the cavity 8 also contributes favourably to obtaining securing of the securing member 1 in adjacent bone tissue.

The securing member 1 comprises, preferably, at its outer end means 9 for non-rotatable cooperation with a tool. The means 9 has preferably the character of a key grip, which may have a polygonal cross section for cooperation with a corresponding tool. The securing member 1 may be screwed into the hole in question by the means 9 and furthermore, the means 9 may serve for cooperation with a tool while the support member 2 is secured

to the securing member 1, said tool having the purpose to avoid rotation of the securing member 1 when the support member 2 is connected thereto.

The support member 2 and securing member 1 have cooperating surfaces which are complementary concave and convex respectively and arranged to allow adjustment of the position of the support member 2 relative to securing member 1, the adjusted position being fixable by means of the connection means. Said adjustability has the purpose to allow, as is immediately apparent from a comparison between Figs 2 and 3, mutual inclination of the support member 2 and securing member 1.

In the embodiment the securing member 1 comprises a concave surface 10 at its extreme end for cooperation with a complementary convex surface 11 on support member 2. More specifically, the surfaces 10, 11 are spherically concave and convex respectively, which involves a possibility to universal inclination of the support member 2 relative to securing member 1.

Said connection means comprise a first member 12 for applying (either directly as illustrated in the drawings or also indirectly as will be discussed finally) on the support member 2 forces actuating the same into engagement with the securing member 1 and a second member 13 for engaging the securing member 1. The connection means are so designed that the distance of the first member 12 to the extreme end of the securing member 1 is variable so as to secure and release respectively the support member 2 and securing member 1 relative to each other. More specifically, the device is such that the securing member 1 and support member 2 are tightened relative to each other when the first member 12 by means of tightening is displaced in a direction towards the securing means 1.

The first member 12 is adapted to apply the securing forces on the support member 2 via cooperating second surfaces 14, 15 which are complementary concave and convex respectively. It is prefer-

red also in this case that the surfaces 14, 15 are spherical in order to achieve the universal possibility to inclination already mentioned hereinabove. More specifically, it is the surface 15 of the first member 12 which is convex whereas the surface 14 of the support member 2 cooperating therewith is concave.

The second member 13 has the character of a shank projecting through holes 16 and 17 respectively in the cooperating surfaces 10, 11 of the securing member 1 and support member 2.

As already mentioned, the connection means comprise a screw 3. The shank of this screw forms the second member 13. The shank 13 has a threaded end portion engaging in a threaded hole 18 in the securing means 1. A widened head of the screw forms the first member 12. An annular portion of head 12 forms the surface 15.

It is preferred that the longitudinal axis of the screw 3 is parallel and preferably also concentric to the longitudinal axis of the securing means 1 and this complete or approximate parallelism and concentricity respectively is always present when the screw 3 is in engagement with hole 18.

As can be seen, the support member 2 has the character of a sleeve having an internal cavity 19, which has a relatively large diameter and which receives the head 12 of screw 3. In the transition between this cavity 19 and the previously mentioned hole 17 there is formed an annular shoulder, which on its side turned away from the securing member 1 comprises the concave surface 14, against which the screw head 12 abuts supportingly. The convex surface 11 abutting against the concave surface of the securing means 1 is present on that side of the shoulder which is turned towards the securing means 1. In other words, the shoulder, which has the character of an end wall of the support member 2, will have the form of spherically curved disc. The cavity 19 of support member 2 may comprise an internal thread or otherwise

suitable, arbitrary means to connect a prosthesis in the form of a tooth, bridge or other design to the support member 2.

When using the device according to the invention, one proceeds in the following manner: initially, a suitable hole is bored in the bone tissue and thereafter the securing member 1 is screwed into the same. After healing, the support member is mounted on the securing member 1 anchored in the bone tissue by causing the screw 3 to engage with a thread in the hole 18 by means of its threaded shank 13, the shank 13 projecting through the hole 17 in the support member 2. As a consequence of the cooperating spherical surfaces 10, 11 and 14, 15 respectively, the support member 2 may be adjusted into varying angle relative to the securing member 1 so that the best position of the support member 2 for mounting the prosthesis is obtained. The adjusted position is fixed by final tightening of the screw 3 so that the widened head 12 thereof presses the support member 2 towards or against the securing member 1. Releasing of support member 2 relative to securing member 1 or adjustment of the position of the support member may easily be done since the head 12, which is provided with suitable means for engaging a tool, of the screw 3 is easily accessible via the cavity 19 of support member 2.

In order to allow the required inclination of support member 2, it is suitable that the cross section of cavity 19 is substantially wider than the cross sectional width of the head 12 of the screw. In order to maximise the possibility for inclination without having to accept an oversized hole 17 in the end wall of support member 2, the shank 13 of the screw 3 may suitably comprise a narrow waist 20 in the portion located opposite to the edge of the hole 17.

In order to achieve a good surface contact between the respective spherical surfaces, the centres of curvature for the surfaces 10, 11, 14, 15 should coincide as viewed in the mounted state of the device. This means that the radius of curvature of the surfaces 14, 15 is somewhat smaller than for the surfaces 10, 11.

Figs 4-5

As appears from Fig 3, sidewardly located and projecting cornered formations occur in the previously described embodiment on mutual inclination of the securing member 1 and support member 2 due to the fact that the cooperating concave and convex respectively surfaces 10, 11 disengage each other in peripheral regions. In the embodiment according to Figs 4 and 5 this disadvantage is avoided by the convex 11 of the complementary surfaces 10, 11 being formed by the external side of such a partially ball shaped part 21, which has a largest cross sectional measure d1 which is larger than the cross sectional measure d2 of the concave 10 of the surfaces. As appears from Fig 5 this causes contact or abutment or at least intimate closeness between the peripheral regions of the concave surface 10 and the convex surface 11 of the ball part 21 on intended mutual inclinations of the securing member 1 and supporting member 2.

It is preferred that the ball part 21 forms at least 1/3 of a complete spherical ball. It is particularly suitable that the ball part 21 forms at least one half of an entirely spherical ball.

It is preferred that the ball part 21 is designed on the support member 2 whereas the concave surface 10 is designed on the securing member 1. In such a design the concave 14 of the second surfaces 14, 15 is designed on the internal side of the ball part 21 since the ball part 21 is hollow. The convex surface 15 is designed on the second member 12, which, in the embodiment illustrated, is formed by the head of a screw.

Furthermore, it is preferred that the ball part 21 has a largest diameter which is larger than the diameter of the support member 2 for the rest, the diameter of upper parts of support member 2 preferably being substantially equally large as the diameter of the upper part of the securing member 1.

POSSIBLE MODIFICATIONS

The device described may of course be modified in several ways within the frame of the inventive concept. An obvious possibility to modification resides in designing the surface 11 of the support member 2 as concave whereas the surface 10 of the securing member 1 would be convex. Such a modification would of course necessitate the surface 14 having to be convex whereas surface 15 would have to be concave. Furthermore, it is to be mentioned that the first member 12 must not necessarily have the character of the head of a screw; instead, the member 12 could be formed by a nut in thread engagement with a threaded shaft connected to the securing member 1. This threaded shaft could then be arranged in one piece with the securing member 1 but alternatively, the shank could also present a threaded portion for tightening the shank into a threaded hole corresponding to the one denoted 18 in the securing member 1. Accordingly, this nut would comprise a concave or convex annular surface for pressing abutment or contact with a corresponding surface on the support member 2. Furthermore, it should be mentioned that it is not necessary for the member 12 to abut directly against the support member 2; instead an element, e.g. a washer, could be arranged between member 12 and support member 2, said element possibly presenting, on one side thereof, a flat surface for abutting against a corresponding flat surface of member 12 and, on its opposite side, a concave or convex surface for abutting against a complementary convex or concave surface on support member 2. Instead of designing the convex and concave respectively surface 14 on the support member 2 it would also be possible to arrange an element in the form of a washer, which would abut planarly against the support member 2 and which would comprise a convex or concave surface for cooperating with a complementary concave or convex surface on member 12 or a further element, e.g. in the form of a washer, which by means of the member 12 would be pressable in a direction towards or against the securing member 1.

Claims

1. A device for anchoring prostheses, in particular dental prostheses, comprising a securing member (1) to be secured in bone tissue, a support member (2) for supporting the prostheses and means (3, 12, 13, 18) for connecting the securing member and the support member, said support member and securing member comprising cooperating first surfaces (11, 10), which are complementary concave and convex respectively and arranged to allow adjustment of the position of the support member (2) relative to the securing member (1), said adjusted position being securable by said connection means, said connection means comprising a first member (12) for applying, on the support member (2), forces actuating the support member into engagement with the securing member (1),

c h a r a c t e r i z e d in that the first member (12) is adapted to apply the forces on the support member (2) via cooperating second surfaces (15, 14) being complementary concave and convex respectively.

2. A device according to claim 1,

c h a r a c t e r i z e d in that the concave (14) of the second surfaces is designed on the first member (12) or on the support member (2) or on an element, e.g. a washer, arranged therebetween.

3. A device according to claim 1 or 2,

c h a r a c t e r i z e d in that the convex (15) of the second surfaces is designed on the support member (2) or on the first member (12) or on an element, e.g. a washer, arranged therebetween.

4. A device according to claim 1,

c h a r a c t e r i z e d in that the concave (10) on the first surfaces is designed on the securing member (1), the convex (11) of the first surfaces on the support member (2), the concave (14) of the second surfaces on the support member (2) or on an element

abutting against the latter and the convex (15) of the second surfaces on the first member (12) or an element abutting thereagainst.

5. A device according to claim 1,
c h a r a c t e r i z e d in that the convex (11) of the first surfaces is designed on the securing member (1), the concave (10) of the first surfaces on the support member (2), the convex (15) of the second surfaces on the support member (2) or an element abutting thereagainst and the concave (14) of the second surfaces on the first member (12) or an element abutting thereagainst.

6. A device according to any preceding claim,
c h a r a c t e r i z e d by the connection means comprising a screw (3), a head of which forms the first member (12) and a threaded shank (13) of which engages in a threaded hole (18) in the securing means (1).

7. A device according to any preceding claim,
c h a r a c t e r i z e d in that the head (12) of the screw is received in an internal space (19) in the support member (2) and that the shank (13) of the screw projects through holes (16, 17) in the first cooperating surfaces.

8. A device according to any preceding claim,
c h a r a c t e r i z e d in that the first member (12) comprises the concave or convex second surface (15) and abuts directly with said surface against the remaining convex and concave respectively second surface (14) on the support member (2).

9. A device according to any of claims 1-5 and 8,
c h a r a c t e r i z e d in that the first member (12) is formed by a nut and that the connection means also comprise a second member (13) connected to the securing member (1), said second member (13) being formed by a shank provided with a thread for engaging the nut (12).

10. A device according to any preceding claim,
c h a r a c t e r i z e d in that the convex (11) of the comple-
mentary first surfaces (10, 11) is formed by the external side of
a ball part (21), the largest external ball diameter (d1) of
which is larger, preferably substantially larger, than the
diameter (d2) of the concave (10) of the first surfaces (10, 11).

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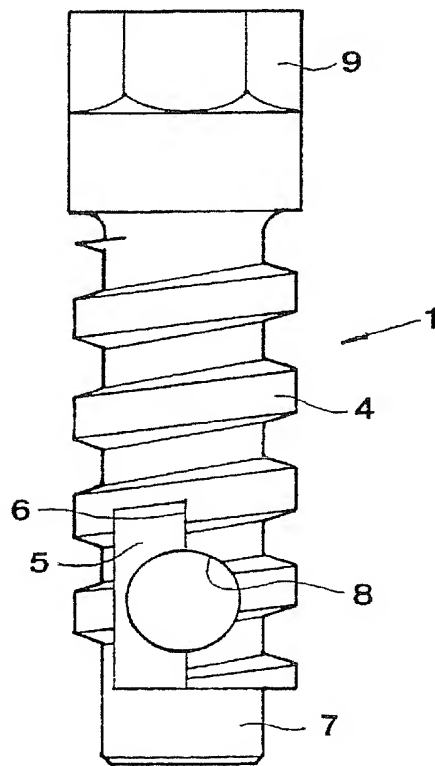
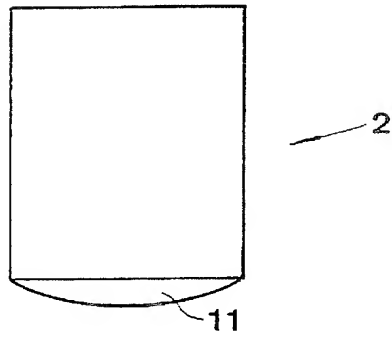
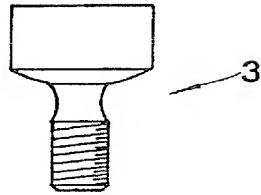


Fig 1

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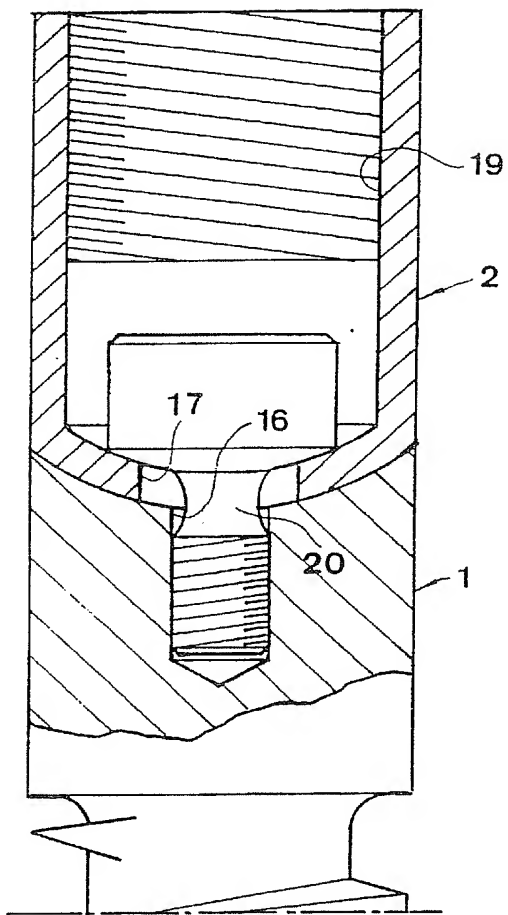


FIG 2

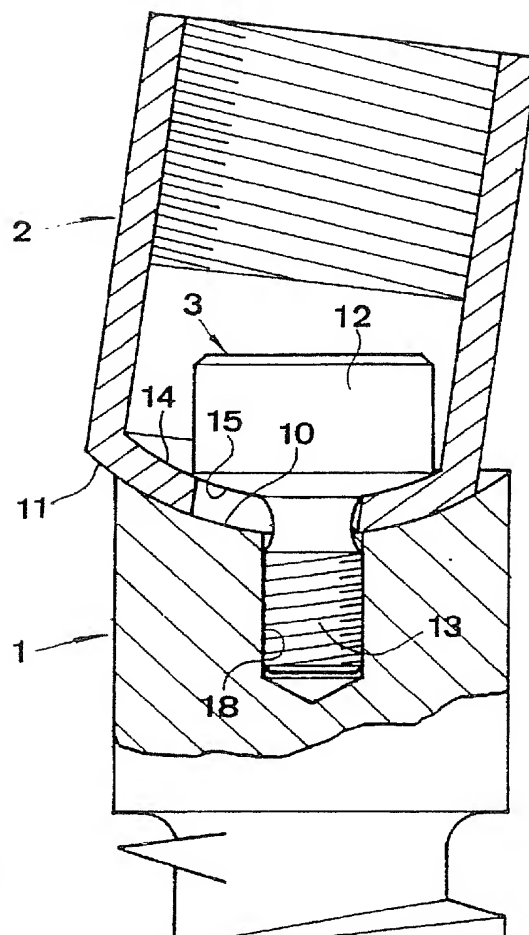


FIG 3

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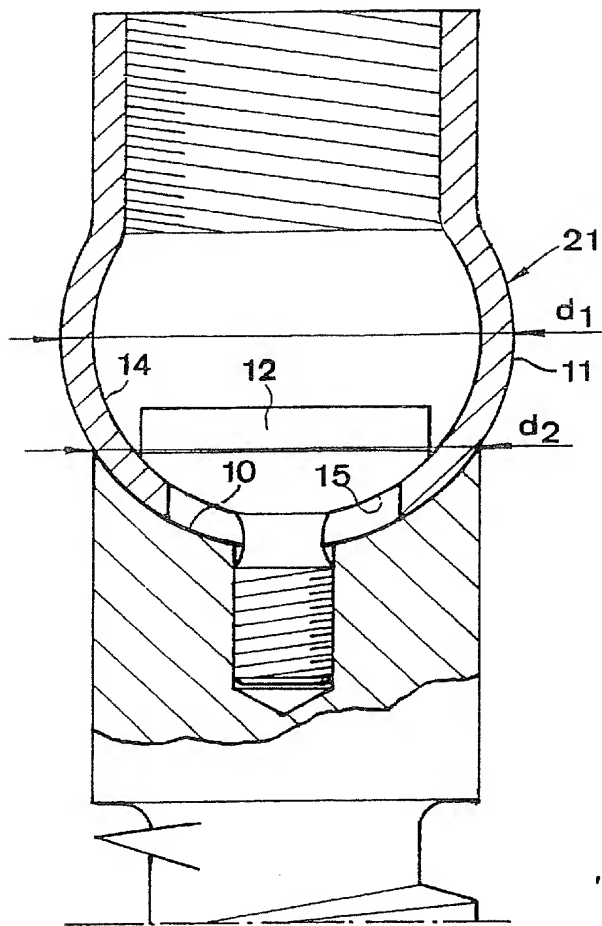


Fig 4

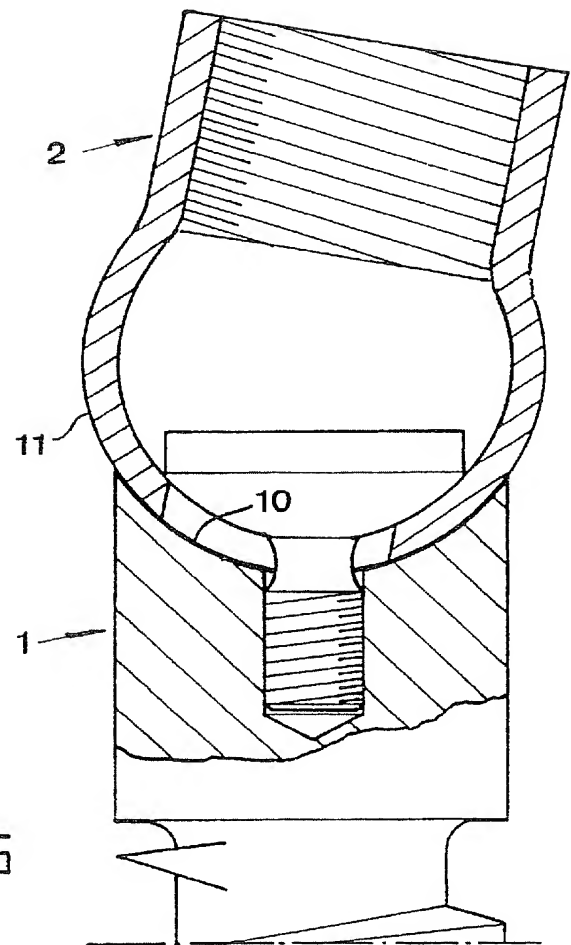


Fig 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00577

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: A 61 C 8/00								
II. FIELDS SEARCHED <div style="text-align: center; margin-top: 10px;">Minimum Documentation Searched⁷</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">Classification System</th> <th style="width: 80%;">Classification Symbols</th> </tr> <tr> <td style="height: 40px; vertical-align: top;">IPC5</td> <td style="vertical-align: top;">A 61 C</td> </tr> </table> <div style="text-align: center; margin-top: 10px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div> <div style="margin-top: 20px;">SE,DK,FI,NO classes as above</div>			Classification System	Classification Symbols	IPC5	A 61 C		
Classification System	Classification Symbols							
IPC5	A 61 C							
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%;">Category *</th> <th style="width: 60%;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%;">Relevant to Claim No.¹³</th> </tr> <tr> <td style="height: 300px; vertical-align: top;">A</td> <td style="vertical-align: top;"> WO, A1, 9004951 (WILJE, OSCAR) 17 May 1990, see the whole document <div style="text-align: center; margin-top: 20px;">-----</div> </td> <td style="vertical-align: top;">1-10</td> </tr> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	WO, A1, 9004951 (WILJE, OSCAR) 17 May 1990, see the whole document <div style="text-align: center; margin-top: 20px;">-----</div>	1-10
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>								
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Date of the Actual Completion of the International Search 2nd January 1992 </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report 1-01-93 </td> </tr> <tr> <td style="width: 50%; padding: 5px;"> International Searching Authority SWEDISH PATENT OFFICE </td> <td style="width: 50%; padding: 5px;"> Signature of Authorized Officer Jack Hedlund </td> </tr> </table>			Date of the Actual Completion of the International Search 2nd January 1992	Date of Mailing of this International Search Report 1-01-93	International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer Jack Hedlund		
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00577

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 31/10/91
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9004951	90-05-17	AU-D- 4502189	90-05-28
		SE-B- 465152	91-08-05
		SE-A- 8803984	88-11-03
		SE-A- 8903554	90-05-04

